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Some of the Pteridophytes of North Carolina and Their Distribution

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The state of North Carolina embraces a region of peculiar fascination to the botanist, especially if he is floristically inclined and interested in observing and studying plants in their native homes. The flora of the state is rich in variety, due largely to its latitude and varied topographical features which include a seacoast at one end, a mountainous region at the other, and a broad area of foothills of varying altitudes between. A correspondence in the distribution of some of the species which make up the flora and fauna of North Carolina with these three main physiographical regions has led to a division of the state into three biological or life zones. These are, the eastern or Atlantic coastal plain, the middle or piedmont, and the western or the mountain. From the standpoint of vegetation, although it may be easy to say that this or that species is found only in this or that zone, it is difficult to draw sharp lines of separation between them. This is due to a considerable overlapping of species and to the fact that some species are common to all of them. However, while there may be overlapping, the proportion of the species which make up the composition of the flora varies enough so that the physiognomy of the vegetation is different in the differ-

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ent zones. The flora of the coastal plain is more distinctive than the other two and is more sharply delimited from the piedmont than the latter is from the mountain zone.

While my interest in the plants of North Carolina since coming here eleven years ago has not been confined to ferns and fern allies, I have in all my excursions taken notice of them and included them in my collections. Since, so far as I know, no recent report has been made of these plants from this state, I thought it might be of interest to write down some of the observations which I have made.

From the standpoint of distribution the club mosses seem to be the most definite. *Lycopodium alopecuroides* and *L. carolinianum* are confined to the Atlantic coastal plain. Besides these, is found on sand ridges *Selaginella acanthonota*, a xerophytic form which I have not collected but which has been reported by Wells¹ and others. In the middle, or piedmont section, the only common club moss is *Lycopodium complanatum* or "running cedar" as it is locally called. *Selaginella apus* is found along ditches and in swampy places but it does not seem to be as abundant here as in the western section. In the mountain section I have never seen *L. complanatum* where it seems to be replaced by the closely related species *L. tristachyum*. This is found in rich soil, especially near upland bogs where it is associated with *L. obscurum*. At higher altitudes, under spruce and fir, *L. lucidulum* is quite common and may extend lower down along the streams. In the southwestern section of the mountains of North Carolina especially where more rocky slopes are exposed, the rock *Selaginellas* are

¹ Wells, B. W. Plant communities of the coastal plain of North Carolina and their successional relations. *Ecology*, Vol. IX, No. 2, April, 1928.

very common and give a greenish tint to the pale lichen associations composed mostly of reindeer moss (*Cladonia*). The most common of these is apparently *S. tortipila*. Others reported from this section are *S. sherwoodii* and *S. rupestris*,² neither of which I have to my knowledge collected.

The first time I ever saw *Isoetes* (Plate 7) in nature was in a ditch near Rosman, in the summer of 1922. This was identified by Dr. Pfeiffer, of the Boyce Thompson Institute of Plant Research, as *I. Engelmannii*. Since then I have found it in great abundance in many of the artificial lakes of western North Carolina.

The only *Equisetum* I have found in the state is *E. praealtum* Raf. (*E. robustum*). This species grows in large patches between Durham and Chapel Hill. The only other place where I have found it is along a road near the Tuckasee Station between Sylva and Glenville. Other *Equisetums* have been reported from the state but apparently these are rather rare and local.

The Bulb Fern (*Cystopteris bulbifera*) seems to be rare in North Carolina as is also the Purple Cliff Brake (*Pellea atropurpurea*). The former I have not found except in a spring which gushes out of a granite wall in the Nanthahala Gorge between Bryson City and Andrews, and the latter was found by one of my students, Miss Susan B. Leonard, of Atlanta, Georgia, at Chimney Rock.

The Climbing Fern (*Lygodium palmatum*) I have not collected myself but I have obtained specimens from Professor E. H. Hall, of the North Carolina College for Women, which he collected at Piedmont Springs, Danberry. Dr. Holmes, of the State Department of Forestry, has told me that he has found it near Tuckasee

² Eseltine, G. P. Van. The allies of *Selaginella rupestris* in the southeastern United States. Contrib. Nat. Herb., Vol. XX, 1917.

Falls. Two other ferns collected by Professor Hall,³ which I have not collected, are *Asplenium Ruta-muraria* and *Ophioglossum vulgatum*, both of which were found near Greensboro.

Of the ferns proper, the coastal plain has very few. The most common ones seem to be, the Cinnamon Fern (*Osmunda cinnamomea*), the Ebony Spleenwort (*Asplenium platyneuron*), the Gray Polypody (*Polypodium polypodioides*), and the Chain Fern (*Woodwardia areolata*). The first three, however, occur all over the state. The Cinnamon Fern is found even on mountain tops and in some places between the ridges grows in great profusion. The Gray Polypody likewise is distributed from the coast to the mountains but its habitat varies. In the eastern part of the state it grows exclusively on trees while in the western section it is found only on rocks. In the piedmont section, especially around Durham, it grows both on trees and rocks. The most common fern in the piedmont section is the Christmas Fern (*Polystichum acrostichoides*). There is considerable variety of ferns in this section but the plants are rather scattered and do not develop in such profusion as some of the same ferns do in the mountainous part of the state. Besides some of the rarer ferns mentioned above, the Mountain Spleenwort (*Asplenium montanum*) seems also to be confined to the western section. It is quite abundant in cracks in granite cliffs, especially near waterfalls. In the mountain section the ferns grow in many places in great profusion. It is not uncommon to see the New York Fern (*Dryopteris noveboracensis*), the Interrupted Fern (*Osmunda Claytoniana*), the Lowland Lady Fern (*Athyrium asplenioides*), and the Hay-

³ Hall, Earl H. A partial check list of the ferns found in the Mountain Park and Roaring Gap region. Jour. Elisha Mitchell Scientific Society, Vol. 46, No. 1, Nov., 1930.



ISOETES ENGELMANNI VAR. CAROLINIANA A. A. EATON FROM MED-
FORD POND NEAR LAKE JUNALUSKA, NORTH CAROLINA

scented Fern (*Dennstaedtia punctilobula*) in almost pure stands. The Hay-scented Fern seems to be especially hardy and is favored by grazing so that in some upland pastures it is gradually replacing all other vegetation (Plate 8).

Below is a list of the ferns and fern allies from North Carolina which I have collected and a few which have been collected and reported by others recently. After each name is given the name of the section in which each is most likely to be found. Where two sections are given, the first one is where the fern is found in greater abundance. The ones marked * I have not collected myself.

OPHIOGLOSSACEAE

* <i>Ophioglossum vulgatum</i> L.	Piedmont
<i>Botrychium virginianum</i> (L.) Sw.	Piedmont and western
<i>Botrychium dissectum</i> (Spreng.) Torr.	Piedmont and western
<i>Botrychium obliquum</i> Muhl.	Piedmont and western

OSMUNDACEAE

<i>Osmunda cinnamomea</i> L.	General
<i>Osmunda regalis</i> L.	Western and piedmont
<i>Osmunda Claytoniana</i> L.	Western and piedmont

SCHIZAEACEAE

* <i>Lygodium palmatum</i> (Bernh.) Sw.	Western
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POLYPODIACEAE

<i>Polypodium virginianum</i> L.	Piedmont and western
<i>Polypodium polypodioides</i> (L.) Watt	General



THE HAY-SCENTED FERN (*DENNSTAEDTIA PUNCTILOBULA*) IN ALMOST PURE STAND IN UPLAND PASTURE,
BLOWING ROCK, NORTH CAROLINA

<i>Pteridium latiusculum</i> var. <i>pseudocaudatum</i> (Clute) Maxon	Piedmont and western
<i>Adiantum pedatum</i> L.	Western and piedmont
<i>Pellaea atropurpurea</i> (L.) Link	Western
<i>Cheilanthes lanosa</i> (Michx.) Watt	Western and piedmont
<i>Asplenium Trichomanes</i> L.	Western and piedmont
<i>Asplenium montanum</i> Willd.	Western
<i>Asplenium platyneuron</i> (L.) Oakes	General
* <i>Asplenium Ruta-muraria</i> L.	Piedmont
<i>Athyrium acrostichoides</i> (Sw.) Diels	Western
<i>Athyrium asplenioides</i> (Michx.) Desv.	Western
<i>Camptosorus rhizophyllus</i> (L.) Link	Western and piedmont
<i>Woodwardia areolata</i> (L.) Moore	Eastern and piedmont
<i>Onoclea sensibilis</i> L.	Western
<i>Polystichum acrostichoides</i> (Michx.) Schott	Piedmont and western
<i>Dryopteris marginalis</i> (L.) A Gray	Western and piedmont
<i>Dryopteris hexagonoptera</i> (Michx.) C. Chr.	Western and piedmont
<i>Dryopteris noveboracensis</i> (L.) A. Gray	Western and piedmont
<i>Dryopteris thelypteris</i> (L.) A. Gray	General
<i>Dryopteris dilatata</i> (Hoffm.) Gray	Western

<i>Dryopteris intermedia</i>	
(Muhl.) Gray	Piedmont and western
<i>Dryopteris cristata</i>	
(L.) A. Gray	Western and piedmont
<i>Dennstaedtia punctilobula</i>	
(Michx.) Moore	Western and piedmont
<i>Cystopteris fragilis</i>	
(L.) Bernh.	Western
<i>Cystopteris bulbifera</i>	
(L.) Bernh.	Western
<i>Woodsia obtusa</i>	
(Spreng.) Torr.	Western and piedmont

EQUISETACEAE

<i>Equisetum praealtum</i> Raf.	Piedmont and western
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LYCOPODIACEAE

<i>Lycopodium lucidulum</i> Michx.	Western
<i>Lycopodium obscurum</i> L.	Western
<i>Lycopodium tristachyum</i> Pursh	Western
<i>Lycopodium complanatum</i> L.	Piedmont
<i>Lycopodium alopecuroides</i> L.	Eastern
<i>Lycopodium carolinianum</i> L.	Eastern

SELAGINELLACEAE

<i>Selaginella apus</i> (L.) Spring	Western and piedmont
<i>Selaginella tortipila</i> A. Br.	Western
* <i>Selaginella Sherwoodii</i> Underw.	Western
* <i>Selaginella rupestris</i> (L.) Spring	Western
* <i>Selaginella acanthonota</i> Underw.	Eastern

ISOETACEAE

Isoetes Engelmannii var.*caroliniana* A. A. Eaton Western

I wish to acknowledge with thanks my obligations to Professor E. H. Hall, of the North Carolina College for Women, for the specimens he has donated to me; to Dr. Maxon and his associates for confirming some of the identifications and making others, and to Dr. Pfeiffer for identifying the *Isoetes*.

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Studies of Equiseta in European Herbaria*

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Various problems in relation to certain species of *Equisetum* had presented themselves to the writer which he was not able to solve with the inadequate material in American herbaria. The summer of 1930 was, therefore, spent in Europe in studying herbarium material and the opportunity was also afforded of attending the Fifth International Botanical Congress at Cambridge, England, August 16-23. The investigations were made at the following herbaria where a large number of records on the geographic distribution of all the species was also obtained: The Amsterdam Botanic Garden, the Berlin Botanic Garden, the Basel Botanic Garden, the Zürich Botanic Garden, the Herbar Boissier of the University of Geneva, the Herbar Delessert of the Geneva Botanic Garden, the Herbarium of Cambridge University, the herbarium of the British Museum of Natural History, London, the Linnean Herbarium owned by the

* Papers from the Department of Botany, the Ohio State University, No. 000.